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On the recovery of pedestal temperature of JET-ILW plasmas with injection of low-Z impurities

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The pedestal confinement has significantly decreased in JET with its metallic ITER-like wall with reference to the carbon wall phase of JET (JET-C). A reduction in pedestal temperature is observed in all scenarios regardless of the level of D-gas injection or value of β_N. In particular, the JET-ILW 2.5MA/2.7T high-δ (δ =0.4) plasmas at n_{ped}/n_{GW} $\geq$0.7, discharges most comparable with JET-C, the pedestal pressure has reduced by 40% with a decrease in pedestal temperature from 0.9keV to 0.5keV with the change of wall. The pedestal stability has been modified with the new wall: the reference JET-C plasmas pedestals had an operational point in the corner of the Peeling-Ballooning (PB) diagram, with pressure limited by intermediate n-numbers (n=5-20), whereas the JET-ILW unseeded plasmas have a lower pressure gradient limited by high n-numbers $\geq$70 (ballooning modes). Seeding N, a low-Z impurity, almost recovers the thermal stored energy, pedestal pressure and pedestal temperature to JET-C levels and with an operation point in the corner of the PB diagram. The mechanisms linked to the pedestal recovery with N are likely related to the mechanisms leading to a decrease in pedestal temperature in the absence of C in the plasma composition. The improved pedestal stability with N is not solely linked to the ideal linear PB stability since N-seeded plasmas in JET-ILW can be in type-III ELM regime and have a higher pedestal pressure than unseeded type-I ELMy H-mode. An increased pedestal pressure via an inward movement of the pedestal pressure from the separatrix is not observed with N seeding. However, we have identified two mechanisms responsible. A first initial mechanism linked to the change in ELM energy losses which raises modestly the average global beta by 10% but allows in return a second mechanism to take place. The considered high-δ plasmas can then benefit, if in type-I ELM regime, from the virtuous cycle (2nd mechanisms) of an increased Shafranov shift, higher pedestal pressure allowing increased core pressure. The operational point can climb towards the corner of the PB diagram. The 1^{st} mechanism which reduces the average ELM energy losses has to be identified but seems to be linked to the SOL/separatrix conditions. The effects of ion diamagnetic drift and plasma rotation on the stability of high-n ballooning modes are being investigated.